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XES STUDIES OF DENSITY OF STATES OF HIGH TEMPERATURE
SUPERCONDUCTORS

Gabriel Jasiolek
Institute of Physics
Polish Academy of Sciences
02-668 Warszawa, Poland

ABSTRACT

X-ray emission spectroscopic studies concerning the superconducting crystals, thin films and ceramics of the Y-Ba-Cu-O, Tm-Ba-Cu-O, Bi-Sr-Ca-Cu-O, Bi-Pb-Sr-Ca-Cu-O and Tl-Ba-Ca-Cu-O types are presented. The contributions of the $13d^9L$, $13d^{10}L$, $13d^{10}LL$ and $13d^{10}L^2$ configurations, where L denotes a ligand hole at the oxygen orbitals, in the spectroscopic pattern of these superconductors is discussed. An attempt to connect the X-ray "as registered" Cu $L\alpha$ emission spectra with the density of states close to the Fermi level, considering an influence of the CuL_3 absorption edge, is presented. The corrected intensity distributions below the Fermi level are found to correspond to the theoretical density of states.

Furthermore, an approach to the average valence of copper basing on the account of the self-absorption and fluorescence effects and on the configurations listed above is shown. The average valence of copper in the materials investigated is estimated to lie in the range of +2.10-2.32 when the formal trivalent copper is considered as this characterized by the $13d^9L$ configuration. The density of states at the Fermi level was estimated to be 2.4 states/eV-cell for a Bi-Sr-Ca-Cu-O crystal and 3.6 states/eV-cell for a Tl-Ba-Ca-Cu-O ceramic.

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